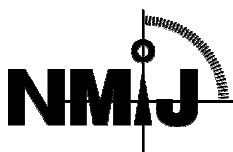


National Institute of Advanced Industrial Science and Technology

## National Metrology Institute of Japan

## Reference Material Certificate



NMIJ CRM 4002-a

No. +++

Benzene



This certified reference material (CRM) was produced in accordance with the NMIJ's management system and in compliance with ISO Guide 34:2000. This CRM is primarily intended for use in calibrating analytical instruments. It is also intended for quality control of analytical instruments, and validation of analytical techniques and instruments.

**Certified Value**

The certified value is purity (amount-of-substance fraction), given in the table below. The uncertainty of the certified value is the half-width of the expanded uncertainty interval calculated using a coverage factor ( $k$ ) of 2.57, which gives a level of confidence of approximately 95 %.

	CAS No.	Certified Value, Amount-of-Substance Fraction (mol/mol)	Expanded Uncertainty, Amount-of-Substance Fraction (mol/mol)
Benzene	71-43-2	0.99992	0.00003

**Analysis**

The certified value was determined by the freezing point depression method with an adiabatic calorimeter by using fractional melting method. The combined standard uncertainty was estimated by the combination of standard uncertainties due to purity determination and homogeneity test.

**Metrological Traceability**

The certified value is determined by the freezing point depression method with an adiabatic calorimeter and is traceable to the SI. Temperature (platinum resistance thermometer), voltage (digital multi-meter) and resistance (standard resistor) of the adiabatic calorimeter were calibrated and they were traceable to the SI.

**Indicative Value**

Purity (mass fraction) is  $(0.99996 \pm 0.00002)$  kg/kg, which is obtained by converting the purity (amount of substance fraction) using the estimated average molecular weight of impurities. The number following the symbol  $\pm$  is the half-width of an expanded uncertainty interval calculated using coverage factor ( $k$ ) of 2.57, which gives a level of confidence of approximately 95 %. Concentration of toluene is 2 mg/kg. This concentration of an impurity was determined by gas chromatography.

**Expiration of Certification**

This certificate is valid until March 31st, 2021, provided that the material remains unopened and stored in accordance with the instructions given in this certificate.

**Sample Form**

This CRM is in the form of a colorless and clear liquid at room temperature. This CRM is sealed in an amber glass ampoule with argon gas. The net amount is 15 mL for each ampoule.

**Homogeneity**

Ten ampoules are sampled from 650 subdivided ampoules with almost same intervals in order of subdivision for homogeneity tests by gas chromatography and Karl-Fischer titrimetry. Area percentages of benzene by gas chromatography and water content by Karl-Fischer titrimetry were measured and evaluated as homogeneity tests. The evaluated variation of purity (amount of substance fraction) between the ampoules due to inhomogeneity were taken into account for the uncertainty of the certified value.

**Instructions for Storage**

This CRM should be stored in a cold (around  $-20\text{ }^{\circ}\text{C}$ ) and dark place.

**Instructions for Use**

This CRM is for laboratory use only. The ampoule of this CRM should be allowed to warm to room temperature before opening. The CRM should be used promptly once an ampoule is opened.

**Precautions for Handling**

Keep away from heat and ignition sources. Wear personal protective equipment such as safety glasses, safety mask, and safety gloves in handling. Refer to the safety data sheet (SDS) on this CRM before use.

**Preparation Method**

This CRM was purified and subdivided by KANTO CHEMICAL CO., INC. This CRM was purified by distillation and drying. 15 mL each of benzene was filled into an amber glass ampoule in argon atmosphere.

**NMIJ Analysts**

Technical manager for this CRM is A. Nomura. The person responsible for production is T. Ihara. Production analyst is Y. Shimizu.

**Collaborator**

Impurity analysis and stability tests until 2005 were performed by National Institute of Technology and Evaluation.

**Technical Information**

Customer registration on the NMIJ Website (given below) will facilitate notification of any revision of the information given above. Technical reports regarding this CRM can be obtained from the contact details given below.

**Reproduction of Certificate**

In reproducing this certificate, it should be clearly indicated that the document is a copy.

April 1, 2015

Ryoji Chubachi  
President

National Institute of Advanced Industrial Science and Technology

If you have any questions about this CRM, please contact:  
National Institute of Advanced Industrial Science and Technology,  
National Metrology Institute of Japan,

Center for Quality Management of Metrology, Reference Materials Office,  
1-1-1 Umezono, Tsukuba, Ibaraki 305-8563, Japan

Phone: +81-29-861-4059; Fax: +81-29-861-4009, <https://www.nmij.jp/english/service/C/>

**Revision history**

March 23, 2004:	The expiration of this certificate was changed to "April 2007" from "April 2004".
March 19, 2007:	The expiration of this certificate was changed to "March 31, 2013" from "April 2007".
December 20, 2011:	The expiration of this certificate was changed to "March 31, 2021" from "March 31, 2013".
April 1, 2015:	"Metrology Management Center" was renamed to "Center for Quality Management of Metrology."